

PART-I : PHYSICS

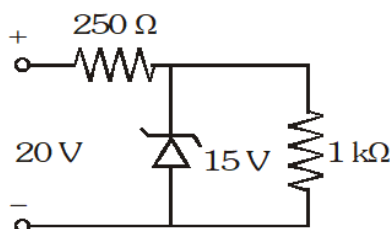
1) The magnetic moment of a circular orbit of radius 'r' carrying a charge 'q' and rotating with velocity v is given by

- (1) $\frac{qvr}{2\pi}$
- (2) $\frac{qvr}{2}$
- (3) $qv\pi r$
- (4) $qv\pi r^2$

2) What is the angle of dip at North pole of earth:-

- (1) 0°
- (2) 45°
- (3) 90°
- (4) 180°

3) A zener diode, having breakdown voltage equal to 15 V, is used in a voltage regulator circuit shown in figure. The current through the zener diode is :-



- (1) 5 mA
- (2) 10 mA
- (3) 15 mA
- (4) 20 mA

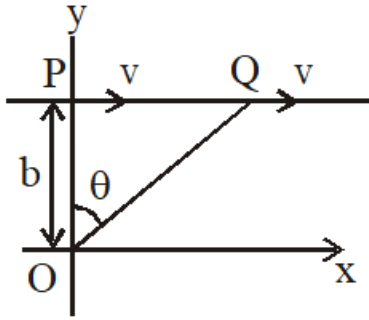
4) What is the output of these two combined gates?



- (1) NOR
- (2) OR
- (3) AND
- (4) NAND

5) An object is moving parallel to x-axis with constant speed v m/s as shown in the figure. Angular

velocity of object w.r.t. origin when object is at Q is :-



- (1) $\frac{v}{b}$
- (2) $\frac{v \sin \theta}{b}$
- (3) $\frac{v \cos \theta}{b}$
- (4) $\frac{v \cos^2 \theta}{b}$

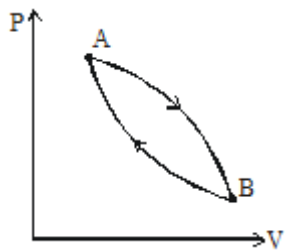
6) Two sound waves of slightly different frequencies have amplitude ratio $\frac{11}{9}$. What is the difference of sound levels in decibels of maximum and minimum intensities heard at a point :-

- (1) 100
- (2) 10
- (3) 16
- (4) 20

7) A man while sitting on an oscillating swing whistles at a frequency 1000 Hz. The swing is oscillating with an amplitude $\pm \frac{\pi}{6}$ radian about the mean position in a vertical plane. Man is sitting over the swing which is at a distance of 2m from the point of suspension of the swing. Another man standing just in front of the mean position of the swing hears the whistle. The maximum frequency heard by the man standing in front of the swing is : (Speed of sound in air = 332 m/s)

- (1) 1016 Hz
- (2) 1007 Hz
- (3) 1003 Hz
- (4) 1000 Hz

8) Figure shows a cyclic process. Heat absorbed in process $A \rightarrow B$ is 100 J. $B \rightarrow A$ is adiabatic compression. Work done on the gas in $B \rightarrow A$ is 70 J. Find change in internal energy in process $A \rightarrow B$:-

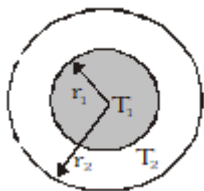


- (1) - 30J
- (2) 100 J
- (3) 30 J
- (4) -70 J

9) A uniform metal rod of length L and mass M is rotating freely in horizontal plane about an axis passing through one of the ends perpendicular to the rod with angular speed ω_0 . If the room temperature increases by T and the coefficient of linear expansion of the rod is α , the decrease in its angular speed is (approximately)

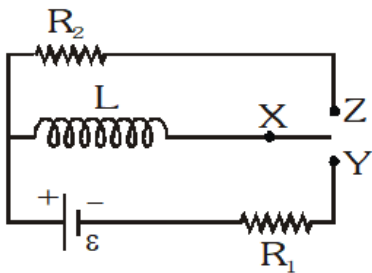
- (1) $2\omega_0\alpha T$
- (2) $\omega_0\alpha T$
- (3) $\frac{1}{2}\omega_0\alpha T$
- (4) $\frac{3}{2}\omega_0\alpha T$

10) The figure shows a system of two concentric shells of radii r_1 and r_2 and kept at temp. T_1 and T_2 , respectively. In between the shells, a substance of thermal conductivity K is filled. The radial rate of flow of heat in a substance between the two concentric spheres is proportional to -



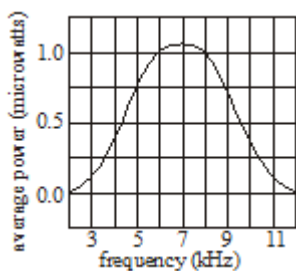
- (1) $\frac{r_1 r_2}{(r_2 - r_1)}$
- (2) $(r_2 - r_1)$
- (3) $(r_2 - r_1)(r_2 r_2)$
- (4) $\ln\left(\frac{r_2}{r_1}\right)$

11) In the circuit shown, X is joined to Y for a long time, and then X is joined to Z. The total heat produced in R_2 is



- (1) $\frac{L\varepsilon^2}{2R_1^2}$
- (2) $\frac{L\varepsilon^2}{2R_2^2}$
- (3) $\frac{L\varepsilon^2}{2R_1R_2}$
- (4) $\frac{L\varepsilon^2R_2}{2R_1^3}$

12) The plot given below is of the average power delivered to an LRC circuit versus frequency. The quality factor of the circuit is :

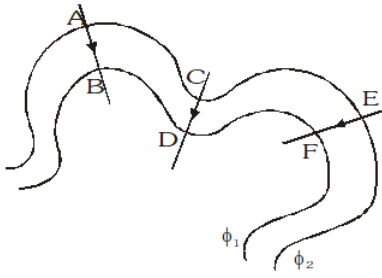


- (1) 5
- (2) 2.4
- (3) 2.8
- (4) 1.4

13) A charge Q is to be divided on two small spheres separated by a distance R . The maximum possible electrostatic force between the spheres can be

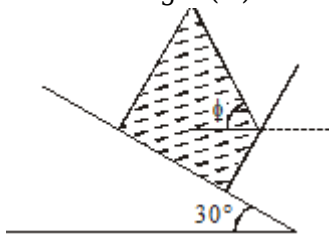
- (1) $\frac{KQ^2}{2R^2}$
- (2) $\frac{KQ^2}{4R^2}$
- (3) $\frac{KQ^2}{R^2}$
- (4) $\frac{2KQ^2}{R^2}$

14) In moving from A to B along an electric field line, the electric field does $1.28 \times 10^{-18} \text{ J}$ of work on an electron. If ϕ_1, ϕ_2 are equipotential surfaces, then potential difference $V_E - V_D$ is equal to



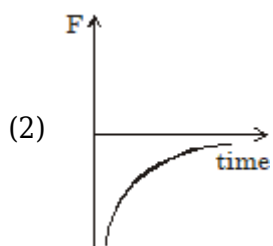
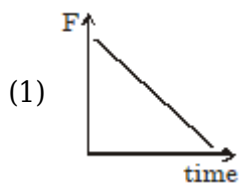
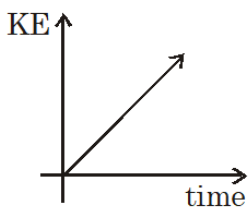
- (1) -8 volt
- (2) +8 volt
- (3) zero
- (4) None of these

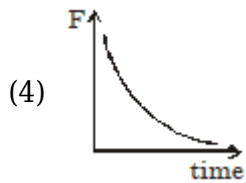
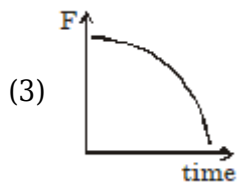
15) A liquid vessel containing liquid moves down a smooth incline plane of angle of inclination 30° . Find the angle (ϕ) made by free surface of liquid with the horizontal plane :-



- (1) 15°
- (2) 30°
- (3) 45°
- (4) 0°

16) The kinetic energy (KE) vs time graph for a particle moving along a straight line is shown in the figure. The force vs time graph for the particle may be





17) A pigeon in flight experiences a force of air resistance given by $F = bv^2$ where v is the flight speed and b is a constant. What is the maximum speed of the pigeon if its power output is P

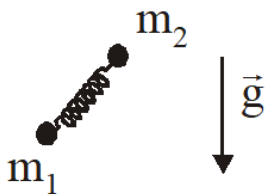
(1) $2\left(\frac{P}{b}\right)^{1/3}$

(2) $\left(\frac{P}{b}\right)^{1/3}$

(3) $\left(\frac{P}{b}\right)^{2/3}$

(4) $2\left(\frac{P}{b}\right)^{2/3}$

18) Two particles are inter connected by an ideal spring (see figure). The spring is compressed and system is projected in air under gravity. If the acceleration of m_1 is $\vec{a}$ find acceleration of m_2 .



(1) $\vec{g}$

(2) $\vec{g} + \vec{a}$

(3) $\frac{m_1\vec{g} - m_1\vec{a}}{m_2}$

(4) $\frac{m_1\vec{g} + m_2\vec{g} - m_1\vec{a}}{m_2}$

19) A particle of mass m is made to move with a uniform speed v_0 along the perimeter of a regular hexagon. The magnitude of impulse applied at each corner of the hexagon is

(1) $2mv^0 \sin\left(\frac{\pi}{6}\right)$

(2) $mv^0 \sin\left(\frac{\pi}{6}\right)$

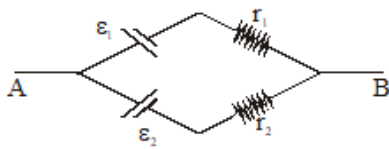
(3) $mv^0 \sin\left(\frac{\pi}{3}\right)$

(4) $2mv^0 \sin\left(\frac{\pi}{3}\right)$

20) An air bubble is inside water. The refractive index of water is $4/3$. At what distance from the air bubble should a point be placed so as form a real image at the same distance from the bubble?

- (1) $2R$
- (2) $3R$
- (3) $4R$
- (4) the air bubble cannot form a real image of real object

21) Two batteries of emf ϵ_1 and ϵ_2 ($\epsilon_2 > \epsilon_1$) and internal resistances r_1 and r_2 respectively are connected in parallel as shown in figure. ϵ_{eq} is the equivalent emf of the batteries between point A & B



- (1) The equivalent emf ϵ_{eq} of the two cells is such that $\epsilon_1 < \epsilon_{eq} < \epsilon_2$.
- (2) The equivalent emf ϵ_{eq} is smaller than ϵ_1 .
- (3) The ϵ_{eq} is given by $\epsilon_{eq} = \epsilon_1 + \epsilon_2$ always.
- (4) ϵ_{eq} is independent of internal resistances r_1 and r_2 .

22) Three different resistor R_1 , R_2 and R_3 are connected in parallel to a battery. Suppose R_1 has 2V across it, $R_2 = 4\Omega$ and R_3 dissipates 6W. What is the current in R_3 ?

- (1) 0.33 A
- (2) 0.5 A
- (3) 2A
- (4) 3A

23) Wavelength of series limit of Lyman series for H - atom is λ . Wavelength of series limit of Balmer series for He^+ is λ' . Which option is correct ?

- (1) $\lambda = \lambda'$
- (2) $\lambda > \lambda'$
- (3) $\lambda < \lambda'$
- (4) None of these

24) The probability of survival of a radioactive nucleus for one mean life is

- (1) $1/e$
- (2) $1-1/e$
- (3) $\ln 2/e$
- (4) $1 - \frac{\ln 2}{e}$

25) A photon and an electron have equal energy E. $\frac{\lambda_{\text{photon}}}{\lambda_{\text{electron}}}$ is proportional to

- (1) $\sqrt{E}$
- (2) $\frac{1}{\sqrt{E}}$
- (3) $1/E$
- (4) Does not depend upon E

26) The dimensional formula of k in the equation: Work Done = $\frac{1}{2} k x^2$. Here ' $\frac{1}{2}$ ' is a dimensionless constant and x is distance, is

- (1) $[M^1 L^0 T^{-2}]$
- (2) $[M^0 L^1 T^{-1}]$
- (3) $[M^1 L^1 T^{-2}]$
- (4) $[M^1 L^0 T^{-1}]$

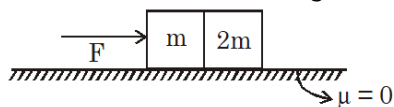
27) Consider a single slit diffraction with $\lambda = 500\text{nm}$ and a lens of diameter 0.1mm then width of central maxima obtained on screen at a distance of 1m will be :

- (1) 5 mm
- (2) 1 mm
- (3) 10 mm
- (4) 2.5mm

28) A sky jumper of mass 80 kg is falling with an acceleration of 6 m/s^2 vertically downwards. The air-resistance opposing the motion is ($g = 10 \text{ m/s}^2$)

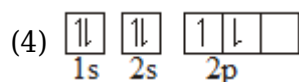
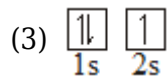
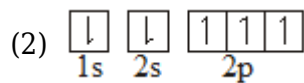
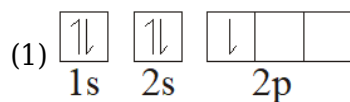
- (1) 800 N
- (2) 240 N
- (3) 320 N
- (4) 480 N

29) Normal force acting between the blocks will be :



- (1) $\frac{F}{3}$
- (2) $\frac{F}{6}$
- (3) $\frac{F}{4}$
- (4) $\frac{2F}{3}$

30) Which of the following is violation of $(n + l)$ rule.



PART-II : CHEMISTRY

1) A ball is thrown upward from the ground. It crosses a point at a height of 25 m twice at an interval of 4 secs. The ball was thrown with the velocity of :-

- (1) 20 m/sec
- (2) 25 m/sec
- (3) 30 m/sec
- (4) 35 m/sec

2) Which of the following order is correct for indicated property

- (1) $I_2 > Br_2 > Cl_2 > F_2$ (Reactivity)
- (2) $Li^+(aq.) > Na^+(aq.) > K^+(aq.)$ (electrical conductivity)
- (3) $Na > Mg > Cu$ (Electropositive character)
- (4) $N^{-3} > O^{-2} > Mg^{+2} > Na^+$ (Ionic size)

3) If all the F atoms are replaced by 'O' atom from SF_4 without changing the number of covalency of 'S' atom then, which of the following property undergoes change in the process

- (1) Oxidation state of 'S' atom
- (2) 'd'-orbital participation in bonding
- (3) Hybridisation of 'S' atom
- (4) Number of lone pair on 'S' atom

4) With respect to halogen or iodide ion four reactions are given below :

- (I) $Cl_2 + H_2O_2 \Rightarrow 2HCl + O_2$
- (II) $Br_2 + H_2O_2 \Rightarrow 2HBr + O_2$
- (III) $I_2 + H_2O_2 \Rightarrow 2HI + O_2$
- (IV) $I^- + H_2O_2 \Rightarrow 2OH^- + I_2$

The correct reactions are -

- (1) Only IV
- (2) I, II and IV

(3) I and IV

(4) I, II and III

5) Which of the following statement is correct?

(1) When three parts of conc. HNO_3 and one part of conc. HCl are mixed, aqua regia is formed

(2) Aqua regia is used for dissolving noble metals like gold and platinum

(3) HgS , Ag_2S and Ag dissolve in aqua regia

(4) All are correct

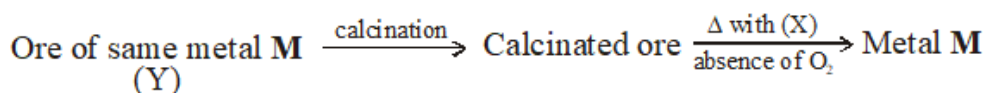
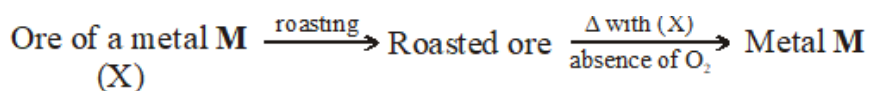
6) Which of the following statement is false -

(1) $[\text{NiCl}_4]^{2-}$ ion is paramagnetic and tetrahedral but $[\text{PtCl}_4]^{2-}$ are diamagnetic and square planar

(2) $[\text{CoF}_6]^{3-}$ ion is paramagnetic but $[\text{NiF}_6]^{2-}$ ion is diamagnetic and low spin

(3) Δ_0 order : $[\text{CrCl}_6]^{3-} < [\text{Cr}(\text{NH}_3)_6]^{3+} < [\text{Cr}(\text{CN})_6]^{3-}$

(4) bis(dimethylglyoximato)nickel(II) is diamagnetic and tetrahedral complex



7)

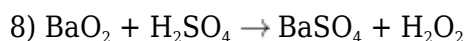
Select correct option :

(1) X = Chalcocite Y = Malachite

(2) X = Galena Y = Cerrusite

(3) X = Zinc blende Y = Calamine

(4) (1) and (2) both are correct



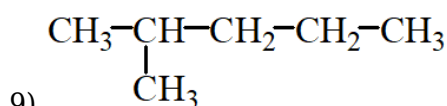
In the above method of preparation of H_2O_2 , now-a-days H_3PO_4 (conc.) is used instead of conc. H_2SO_4 . Because -

(1) H_2SO_4 catalyses the backward reaction

(2) H_2SO_4 catalyses the decomposition of H_2O_2

(3) H_3PO_4 catalyses the backward reaction

(4) None of these



9)

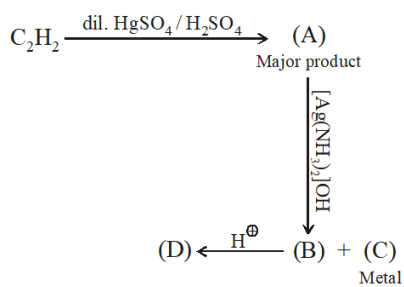
Number of monochlorinated product when following compound undergo reaction with $\text{Cl}_2/\text{h}\nu$ is -

(1) 10

(2) 15

(3) 8

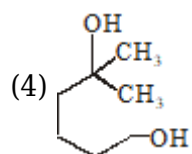
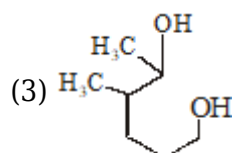
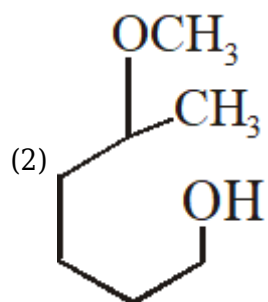
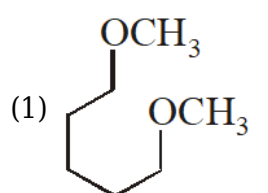
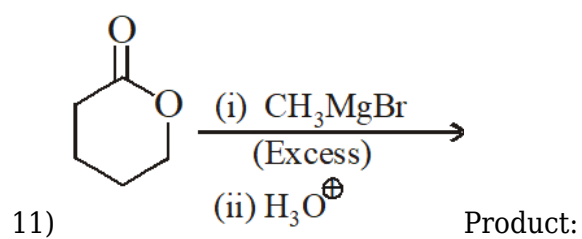
(4) 20



10)

Give suitable reagent to convert 'D' to 'A':

- (1) NaBH_4
- (2) LiAlH_4
- (3) (i) PCl_3 (ii) $\text{H}_2/\text{Pd-BaSO}_4$
- (4) $\text{Ca}(\text{OH})_2 / \Delta$



12) Which is antihistamines drugs

- (1) Cimetidine

- (2) Iproniazed
- (3) Phinelzine
- (4) Equanil

13) Which of the following is not an example of Green Chemistry?

- (1) Reaching methylamine and phosgene to produce methyl isocyanide
- (2) Replacement of CFC as blowing agent in the manufacture of polystyrene foam sheets
- (3) Catalytic dehydrogenation of the diethanol amine without using cyanide and formaldehyde.
- (4) Replacement of organotins by sea-nine as antiflowling compound in sea marines.

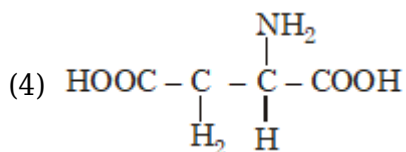
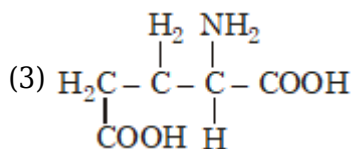
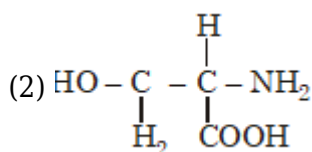
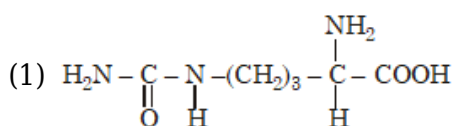
14) Which of the following is not a non-narcotic analgesic?

- (1) Phenylbutazone
- (2) Morphine
- (3) Ibuprofen
- (4) All of these

15) Which of the following is not a broad spectrum antibiotics ?

- (1) Penicilin
- (2) Ofloxaen
- (3) Aminoglycorides
- (4) Chloromphenicol

16) Which of the following is a basic amino acid?



17) Which of the following is wrong?

- (1) PMMA is called plexiglan

- (2) PTFE is called teflon
- (3) SBR is called natural rubber
- (4) LDPE is called low density polyethylene

18) Select the incorrect statements-

- (1) Lyophobic sols are irreversible sols.
- (2) Micelles formation takes place only above kraft temperature.
- (3) PO_4^{3-} ions have more coagulation value than SO_4^{2-} ions for coagulation of positive sols.
- (4) The values of the colligative properties observed experimentally are very small for colloids compare to the true solutions.

19) pK_a values for several acid-base indicators are given. Which indicator is most suitable for titration of weak acid (0.1 M, 100 ml) with strong base (0.1 M) ?

- (1) Bromothymol blue ($\text{pK}_a = 6.8$)
- (2) p-Nitrophenol ($\text{pK}_a = 6$)
- (3) Thymol blue ($\text{pK}_a = 8.8$)
- (4) 2, 4-Dinitrophenol ($\text{pK}_a = 3.5$)

20) In the reaction $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$ the partial pressure of PCl_3 , Cl_2 and PCl_5 are 0.3, 0.2 and 0.6 atm respectively. If partial pressure of PCl_3 and Cl_2 was increased twice, what will be the partial pressure of PCl_5 in atm :-

- (1) 0.3
- (2) 1.2
- (3) 2.4
- (4) 0.15

21) If a closed system has adiabatic boundaries , then at least one boundary must be -

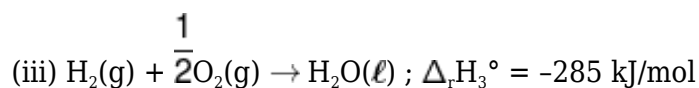
- (1) Permeable
- (2) Semipermeable
- (3) Imaginary
- (4) Movable

22) Addition of NH_4Cl to NH_4OH solution results

- (1) Increase in pH
- (2) decrease in pH
- (3) no change in pH
- (4) unpredictable change in pH

23) Determine enthalpy of formation for $\text{H}_2\text{O}_2(l)$, using this listed enthalpies of reaction :

- (i) $\text{N}_2\text{H}_4(l) + 2\text{H}_2\text{O}_2(l) \rightarrow \text{N}_2(g) + 4\text{H}_2\text{O}(l)$; $\Delta_r H_1^\circ = -818 \text{ kJ/mol}$
- (ii) $\text{N}_2\text{H}_4(l) + \text{O}_2(g) \rightarrow \text{N}_2(g) + 2\text{H}_2\text{O}(l)$; $\Delta_r H_2^\circ = -622 \text{ kJ/mol}$



- (1) -383 kJ/mol
- (2) -187 kJ/mole
- (3) -498 kJ/mol
- (4) None of these

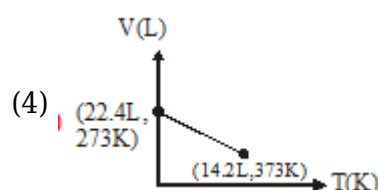
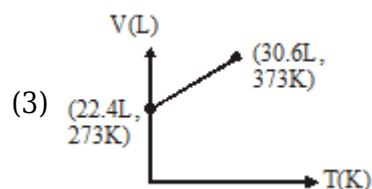
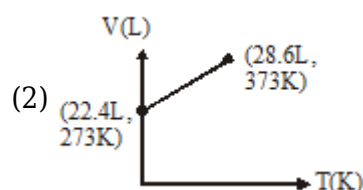
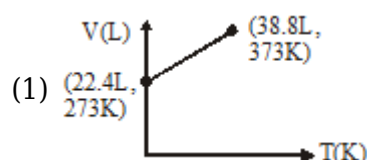
24) Which of the following solution having maximum pOH for same concentration

- (1) NH_4OH
- (2) NH_4Cl
- (3) $\text{CH}_3\text{COONH}_4$
- (4) NaOH

25) The reaction $\text{A} \rightarrow \text{B}$ follows first order kinetics. The time taken for 0.8 mole of A to produce 0.6 mole of B is 1 hour. What is the time taken for conversion of 0.9 mole of A to produce 0.675 mole of B :

- (1) 1 hour
- (2) 0.5 hour
- (3) 0.25 hour
- (4) 2 hour

26) Which of the following volume (V) - temperature (T) plots represents the behaviour of one mole of an ideal gas at one atmospheric pressure -





In the above reaction how many moles of H_2O would be formed for each mole Cl_2 liberated

- (1) $5/4$
- (2) $4/5$
- (3) $5/8$
- (4) $8/5$

28) How many milli moles of sucrose should be dissolved in 500 gms of water so as to get a solution which has a difference of 103.57° between boiling point and freezing point. ($K_f = 1.86 \text{ K Kg mol}^{-1}$, $K_b = 0.52 \text{ K Kg mol}^{-1}$)

- (1) 500
- (2) 900
- (3) 750
- (4) 650

29) A current of 2.6 ampere was passed through CuSO_4 solution for 380 sec. The amount of Cu deposited is (at wt. of Cu = 63.5)

- (1) 0.3250 g
- (2) 0.635 g
- (3) 6.35 g
- (4) 3.175 g

30) If velocity of an electron in 1st orbit of H-atom is v , what will be the velocity of 3rd orbit of Li^{2+}

- (1) v
- (2) $v/3$
- (3) $3v$
- (4) $9v$

PART-III : MATHEMATICS

1) The cartesian coordinates of the point of intersection of the normals drawn at two points of parabola $y^2 = 4x$ having the parameters $t_1=1$ and $t_2= 2$ is -

- (1) (9,-18)
- (2) (9,-6)
- (3) (3,-6)
- (4) (1,2)

2) The points of contact Q and R of tangents from the point P(2, 3) to the parabola $y^2 = 4x$ are -

- (1) (9, 6) and (1, 2)
- (2) (4, 4) and (9, 6)

(3) $(9, 6)$ and $\left(\frac{1}{4}, 1\right)$

(4) $(1, 2)$ and $(4, 4)$

3) The value of $\int_{-1}^1 \max(2-x, 2, 2+x) dx$ is -

(1) 4

(2) 5

(3) 2

(4) 3

4) Equation of a line which passes through $(1, -2)$ and makes equal intercepts on axes is

(1) $x - y - 3 = 0$

(2) $x - y - 3 = 0$

(3) $x + y - 1 = 0$

(4) $x + y + 1 = 0$

5) If $F(x) = \int_1^x (t) dt$, where $f(t) = \int_1^{t^2} \frac{\sqrt{1+u^4}}{u} du$, then $F'''(1)$ equals :-

(1) $\frac{1}{\sqrt{2}}$

(2) $\sqrt{2}$

(3) 2

(4) $2\sqrt{2}$

6) Equation of line equidistant from the lines $2x + 3y + 5 = 0$ & $4x + 6y = 11$ is -

(1) $8x + 12y - 1 = 0$

(2) $2x + 3y - 1 = 0$

(3) $4x + 6y - 1 = 0$

(4) $8x + 12y - 3 = 0$

7) $\lim_{t \rightarrow 0^+} \frac{\int_0^{t^4} \sin \sqrt{x} dx}{t^2 (e^t - 1) \tan t}$ is equal to -

(1) 4

(2) -2

(3) 0

(4) 3

8) Let $\vec{a}$ & $\vec{b}$ are two vectors making angle θ with each other, then unit vectors along bisector of $\vec{a}$ & $\vec{b}$ is :

- (1) $\frac{\hat{a} + \hat{b}}{\pm 2}$
- (2) $\frac{\hat{a} + \hat{b}}{\pm 2 \cos \theta}$
- (3) $\frac{\hat{a} + \hat{b}}{\pm 2 \cos \theta/2}$
- (4) $\frac{(\hat{a} + \hat{b})}{|\hat{a} + \hat{b}|}$

9) The value of the determinant $\begin{vmatrix} a_1 & ma_1 & b_1 \\ a_2 & ma_2 & b_2 \\ a_3 & ma_3 & b_3 \end{vmatrix}$ is-

- (1) 0
- (2) $ma_1a_2a_3$
- (3) $ma_1b_2a_2$
- (4) $mb_1b_2b_3$

10) Let α, β & γ be distinct real numbers. The points whose position vector's are $\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k}$; $\beta\hat{i} + \gamma\hat{j} + \alpha\hat{k}$ and $\gamma\hat{i} + \alpha\hat{j} + \beta\hat{k}$

- (1) are collinear
- (2) form an equilateral triangle
- (3) form a scalene triangle
- (4) form a right angled triangle

11) If $A + B + C = \pi$, then $\begin{vmatrix} \sin(A + B + C) & \sin B & \cos C \\ -\sin B & 0 & \tan A \\ \cos(A + B) & -\tan A & 0 \end{vmatrix}$ equals -

- (1) 0
- (2) $2 \sin B \tan A \cos C$
- (3) 1
- (4) None of these

12) If $L = \lim_{x \rightarrow 0^+} (\operatorname{cosec} x)^{1/\ln x}$, then the value of $\ln L$ is -

- (1) 1
- (2) -1

- (3) 0
(4) None of these

13) Which of the following is not an orthogonal trajectory of the system of curves $\left(\frac{dy}{dx}\right)^2 = \frac{4}{x}$?

- (1) $9(y + c)^2 = x^3$
(2) $y + c = \frac{-x^{3/2}}{3}$
(3) $\frac{y + c}{x^{3/2}} = \frac{1}{3}$
(4) $9(y + c)^2 + x^3 = 0$

14) $\lim_{x \rightarrow 1} \frac{\sqrt{x+8} - \sqrt{8x+1}}{\sqrt{5-x} - \sqrt{7x-3}} =$

- (1) $\frac{7}{12}$
(2) 0
(3) -1
(4) does not exist

15) The order and degree of the differential equation whose solution is $y = cx + c^2 - 3c^{3/2} + 2$, where c is a parameter, are respectively -

- (1) 1, 4
(2) 1, 3
(3) 2, 2
(4) 1, 2

16) If $f(x) = \frac{3x+2}{5x-3}$, then -

- (1) $f^{-1}(x) = f(x)$
(2) $f^{-1}(x) = -f(x)$
(3) $f \circ f(x) = -x$
(4) $f^{-1}(x) = -\frac{1}{19f(x)}$

17) If $x^2 + y^2 = 5$ and $2y'' + ky^{-3} = 0$, then k is equal to -

- (1) 5
(2) -5
(3) 10
(4) -10

18) If the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ is inscribed in a square of side length $5\sqrt{2}$, then area of ellipse is -

- (1) 4π
- (2) 8π
- (3) 10π
- (4) 12π

19)

Which of the following is not an odd function ?

- (1) $g(x) - g(-x)$
- (2) $\sin(g^4(x) - g^4(-x))$
- (3) $\ln\left(\frac{x^4 + x^2 + 1}{x^2 + x + 1}\right)$
- (4) $x^3 g^6(x) \cdot g^6(-x) + \tan^3(\sin^5 x)$

20) If the eccentricity of the ellipse $\frac{x^2}{a^2 + 2} + \frac{y^2}{a^2 + 5} = 1$ be $\frac{1}{\sqrt{3}}$, then length of latus rectum of ellipse is -

- (1) 4
- (2) $\frac{18}{\sqrt{6}}$
- (3) $\frac{10}{\sqrt{6}}$
- (4) 8

21) Eccentricity of the curve $(x - 4)(y - 6) = 25$ is equal to -

- (1) $\frac{1}{\sqrt{2}}$
- (2) $\sqrt{2}$
- (3) $\frac{1}{2}$
- (4) 2

22) Let a curve $y = f(x)$ satisfying differential equation $\frac{dx}{dy}(1 + y + x - x^2) = 1$. It is also given that $f(0) = -1$, then which of the following is false

- (1) $f'(0) - f(0) = 1$
- (2) $f'(1) > 0$
- (3) $f'(1) < 0$
- (4) $f''(x)$ is a decreasing function $\forall x \in \mathbb{R}$

23) If the function $f(x) = 2x^2 + 3x + 5$ satisfies LMVT at $x = 2$ on the closed interval $[1, a]$ then the value of 'a' is equal to -

- (1) 3
- (2) 4
- (3) 6
- (4) 1

24) Find the value(s) of t for which the following system is consistent

$$x + y = 1$$

$$tx + y = t$$

$$(1 + t)x + 2y = 3, \text{ is (are) -}$$

- (1) 1, 2
- (2) 2
- (3) 1
- (4) no value

25) Suppose that f is differentiable for all x such that $f'(x) \leq 2$ for all x. If $f(1) = 2$ and $f(4) = 8$ then $f(2)$ has the value equal to -

- (1) 3
- (2) 4
- (3) 6
- (4) 8

26) If $\int_0^{\pi} \frac{x^3 \cos^4 x \sin^2 x dx}{(\pi^2 - 3\pi x + 3x^2)} = k \int_0^{\pi/2} \sin^2 x dx$, then the value of k is :-

- (1) $\frac{\pi}{12}$
- (2) $\frac{\pi}{4}$
- (3) $\frac{\pi}{16}$
- (4) $\frac{\pi}{8}$

27) If the product of the perpendicular distances from any point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ of eccentricity $e = \sqrt{3}$ on its asymptotes is equal to 6, then the length of the transverse axis of the hyperbola is -

- (1) 3
- (2) 6
- (3) 8
- (4) 12

28) Let $I_1 = \int_0^1 \frac{e^x dx}{x+1}$ and $I_2 = \int_0^1 \frac{x^2 dx}{e^{x^3}(2-x^3)}$ then $\frac{I_1}{I_2}$ is equal to -

- (1) $\frac{3}{e}$
- (2) $\frac{e}{3}$
- (3) $3e$
- (4) $\frac{1}{3e}$

29) Consider the following statements -

(I) Constant term in the expansion of $\begin{vmatrix} x^2-3x+2 & x^2+2 & 2-3x \\ x+1 & x^2+x & x^2-1 \\ 6x^2 & 3x & x^2-2 \end{vmatrix}$ is 4.

(II) If $a + b + c > 0$, then $\begin{vmatrix} a & c & b \\ b & a & c \\ c & b & a \end{vmatrix} > 0$.

(III) Let $A = \begin{bmatrix} a & 1 \\ -1 & b \end{bmatrix}$, where $a, b \in \mathbb{R}$. If A is a nilpotent matrix of index 2, then $ab = 1$.

(IV) If $\begin{bmatrix} 1 & x & 3 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ 6 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 9 \end{bmatrix} = [14]$, then $x > 0$.

If T : True & F : False, then the statements in order are -

- (1) TFFF
- (2) TTTT
- (3) TFTF
- (4) TTFF

30) If $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, $J = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$, then $B =$

- (1) $I \cos \theta + J \sin \theta$
- (2) $I \cos \theta - J \sin \theta$
- (3) $I \sin \theta - J \cos \theta$
- (4) $-I \cos \theta + J \sin \theta$

31) The locus of the point of intersection of the perpendicular lines; one belonging to $x + \lambda y - 2 + \lambda = 0$ & the other to $3x - ty + tx - 3t = 0$, λ, t being parameter is -

- (1) circle
- (2) straight line
- (3) pair of straight line
- (4) no locus

32) If A & B are symmetric & C is a skew symmetric matrix, then $ABC - CBA$ is always-

- (1) symmetric matrix
- (2) skew symmetric matrix
- (3) orthogonal matrix
- (4) null matrix

33) The equation of the circle concentric with the circle $x^2 + y^2 + 8x + 10y - 7 = 0$ and passing through the centre of the circle $x^2 + y^2 - 4x - 6y = 0$ is -

- (1) $x^2 + y^2 + 8x + 10y + 59 = 0$
- (2) $x^2 + y^2 + 8x + 10y - 59 = 0$
- (3) $x^2 + y^2 - 4x - 6y + 87 = 0$
- (4) $x^2 + y^2 - 4x - 6y - 87 = 0$

34) If $(1+x)^n = C^0 + C_1x + C_2x^2 + \dots + C_nx^n$, then $\frac{(C_0 + C_1)(C_1 + C_2)\dots(C_{n-1} + C_n)}{C_1C_2\dots C_n}$ equals -

- (1) $\frac{n^n}{(n+1)!}$
- (2) $\frac{(n+1)^n}{n!}$
- (3) $\frac{n^n}{n!}$
- (4) None of these

35) If C_r represent nC_r , then the value of series $C_1 + \frac{C_3}{2} + \frac{C_5}{3} + \frac{C_7}{4} + \dots$ equals -

- (1) $(2^n - 1)$
- (2) $\frac{2^n - 1}{n - 1}$
- (3) $\frac{2^n - 1}{n - 2}$
- (4) $\frac{2^{n+1} - 2}{n + 1}$

36) The expression $2x^2 + 4xy - ky^2 + 4x + 2y - 1$ can be resolved into two linear factors, then the value of k is -

- (1) $-\frac{5}{3}$

- (2) $\frac{5}{3}$
 (3) $\frac{1}{3}$
 (4) $-\frac{1}{3}$

37) $\cos 12^\circ - \cos 24^\circ - \cos 48^\circ + \cos 84^\circ$ is equal to-

- (1) $\frac{1}{2}$
 (2) $-\frac{1}{2}$
 (3) $\frac{\sqrt{5}}{2}$
 (4) $-\frac{\sqrt{5}}{2}$

38) The smallest natural number 'n' such that $\tan(107n)^\circ = \frac{\cos 96^\circ + \sin 96^\circ}{\cos 96^\circ - \sin 96^\circ}$ is -

- (1) 1
 (2) 2
 (3) 3
 (4) none of these

39) The sum of three numbers in G.P. is 21 and the sum of their squares is 189. If the sum to infinite terms for the given G.P. is defined, then the common ratio is -

- (1) $\frac{1}{2}$
 (2) $\frac{1}{3}$
 (3) $\frac{1}{4}$
 (4) none of these

40) If $|z| = 1$, then number of complex number z satisfying equation $z^2 + \bar{z}^2 = z + \bar{z}$ is/are -

- (1) 1
 (2) 3
 (3) 4
 (4) 8

PART-IV(A) : ENGLISH PROFICIENCY

1) DIRECTION : Rearrange the following sentences labelled as (A), (B), (C), (D), and (E) into a meaningful paragraph. Mark the correct combination as the answer:

- (A) If you don't want to meditate or spin yarn, try praying. Listen to whatever music you find absorbing. Take a long shower or shave. Sit in a calming architectural space.
- (B) Benson argues that engaging in any 'trigger' that forces you to quit thinking about your troubles can lead to bold insights, bright ideas and better performance.
- (C) She filed for divorce soon after.
- (D) Go for a stroll in the woods. Have dinner in a quiet restaurant, alone or with a friend.
- (E) Even chores such as ranking leaves or folding laundry can serve as breakout triggers.

- (1) AEBCD
 (2) CBADE
 (3) CDBAE
 (4) BACDE

2) DIRECTIONS : In the given sentences, one word has been underlined. Pick the option that best describes the meaning of the underlined word in the given context.

I don't know who elected him; he always embarrasses me with his gauche behaviour.

- (1) Polished
 (2) Graceless
 (3) Tactful
 (4) Modest

3) DIRECTIONS : In the given sentences, one word has been underlined. Pick the option that best describes the meaning of the underlined word in the given context. The audience fled the hall as his crass cacophony began to sound over the speakers.

- (1) Jarring sound
 (2) Music
 (3) Melody
 (4) Tenor

4) **DIRECTIONS** : Read the following passage carefully and mark the correct answer for the questions given below:

Italian super - luxury sports car manufacturer Lamborghini has spread its wings in India, and it has just opened a dealership in Bengaluru, the IT (information technology) capital of the country. It has already a dealership in Mumbai, the financial capital, and Delhi, the political capital. At a price tag of over Rs. 1 Crore. Who will buy a Lamborghini car? Rather, what gives the Italian car maker the confidence to not only drive into India but also expand its presence? The choice of its location for dealership gives a clue or two to its game plan, and also an insight into its prospective customer profile. While dealership in Mumbai and Delhi are understandable considering the wealth and power that reside in these two metros, the choice of Bengaluru to locate its new dealership indicates that the Italian company is betting big on the neo rich who have sprouted in big numbers in the wake of an unprecedented growth experienced by this city. If super - luxury brand like Lamborghini is sensing an unfolding big opportunity in a New India, other traditional global luxury car makers have turned very ambitious with new launches. Despite high import duty barriers, global luxury car makers continue to believe that roll out new models and ramp up dealership in a bid to sustain the appetite of India's super rich for expensive cars is only likely to grow. After the launch of BMW M5, priced at Rs. 1.35 crore its German rival Mercedes - Benz launched next - generation C- Class, priced at Rs. 40.9 lakh in New Delhi. The C- Class is one of the most successful products of Merc in India. It has so far sold over 20,000 units C- class in India. Till date, Lamborghini had sold around 94 sports cars in the country. It said the high

import duty would impact the company's sales in India, and 2014 might see a lower volume. In 2013, it sold around 22 super - luxury sports cars in India. "The import duty in India is higher than many other countries. We want to sell more cars in the country but the import duty in India is high as much as 167 percent. This huge import tax will impact the sales of the super cars in the country," said Automobile Lamborghini President and CEO Stephan Winkelman. Apart from the high import duty, the late launch of its new model Huracan into India market was another reason for lower sales this year. The company expects to improve the sales next year. Lamborghini is also considering the possibility of launching its SUV in India by 2018. In April 2012 the company showcased its concept SUV at the Beijing Auto Show. Which of the following rationale explains the curtailing of Lamborghini car trade in India?

- (1) The price figure ranges over one crore
- (2) Lofty import duty
- (3) Delayed launch of its new model
- (4) Only 2 and 3

5) DIRECTIONS : Read the following passage carefully and mark the correct answer for the questions given below:

Italian super - luxury sports car manufacturer Lamborghini has spread its wings in India, and it has just opened a dealership in Bengaluru, the IT (information technology) capital of the country. It has already a dealership in Mumbai, the financial capital, and Delhi, the political capital. At a price tag of over Rs. 1 Crore. Who will buy a Lamborghini car? Rather, what gives the Italian car maker the confidence to not only drive into India but also expand its presence? The choice of its location for dealership gives a clue or two to its game plan, and also an insight into its prospective customer profile. While dealership in Mumbai and Delhi are understandable considering the wealth and power that reside in these two metros, the choice of Bengaluru to locate its new dealership indicates that the Italian company is betting big on the neo rich who have sprouted in big numbers in the wake of an unprecedented growth experienced by this city. If super - luxury brand like Lamborghini is sensing an unfolding big opportunity in a New India, other traditional global luxury car makers have turned very ambitious with new launches. Despite high import duty barriers, global luxury car makers continue to believe that roll out new models and ramp up dealership in a bid to sustain the appetite of India's super rich for expensive cars is only likely to grow. After the launch of BMW M5, priced at Rs. 1.35 crore its German rival Mercedes - Benz launched next - generation C- Class, priced at Rs. 40.9 lakh in New Delhi. The C- Class is one of the most successful products of Merc in India. It has so far sold over 20,000 units C- class in India. Till date, Lamborghini had sold around 94 sports cars in the country. It said the high import duty would impact the company's sales in India, and 2014 might see a lower volume. In 2013, it sold around 22 super - luxury sports cars in India. "The import duty in India is higher than many other countries. We want to sell more cars in the country but the import duty in India is high as much as 167 percent. This huge import tax will impact the sales of the super cars in the country," said Automobile Lamborghini President and CEO Stephan Winkelman. Apart from the high import duty, the late launch of its new model Huracan into India market was another reason for lower sales this year. The company expects to improve the sales next year. Lamborghini is also considering the possibility of launching its SUV in India by 2018. In April 2012 the company showcased its concept SUV at the Beijing Auto Show. What kind of strategy is mentioned in the passage about the car selling geographical factor?

- (1) Launching a new model every six months will give lots of choices to buyers.
- (2) Competitive environment leads to better designing of Lamborghini cars.
- (3) Seeking out well - heeled people who have enormously emerged in Bengaluru.
- (4) Mumbai and Delhi are having many rich people, so it was easy for the company to launch their car first here.

6) DIRECTIONS : Read the following passage carefully and mark the correct answer for the questions

given below:

Italian super - luxury sports car manufacturer Lamborghini has spread its wings in India, and it has just opened a dealership in Bengaluru, the IT (information technology) capital of the country. It has already a dealership in Mumbai, the financial capital, and Delhi, the political capital. At a price tag of over Rs. 1 Crore. Who will buy a Lamborghini car? Rather, what gives the Italian car maker the confidence to not only drive into India but also expand its presence? The choice of its location for dealership gives a clue or two to its game plan, and also an insight into its prospective customer profile. While dealership in Mumbai and Delhi are understandable considering the wealth and power that reside in these two metros, the choice of Bengaluru to locate its new dealership indicates that the Italian company is betting big on the neo rich who have sprouted in big numbers in the wake of an unprecedented growth experienced by this city. If super - luxury brand like Lamborghini is sensing an unfolding big opportunity in a New India, other traditional global luxury car makers have turned very ambitious with new launches. Despite high import duty barriers, global luxury car makers continue to believe that roll out new models and ramp up dealership in a bid to sustain the appetite of India's super rich for expensive cars is only likely to grow. After the launch of BMW M5, priced at Rs. 1.35 crore its German rival Mercedes - Benz launched next - generation C- Class, priced at Rs. 40.9 lakh in New Delhi. The C- Class is one of the most successful products of Merc in India. It has so far sold over 20,000 units C- class in India. Till date, Lamborghini had sold around 94 sports cars in the country. It said the high import duty would impact the company's sales in India, and 2014 might see a lower volume. In 2013, it sold around 22 super - luxury sports cars in India. "The import duty in India is higher than many other countries. We want to sell more cars in the country but the import duty in India is high as much as 167 percent. This huge import tax will impact the sales of the super cars in the country," said Automobile Lamborghini President and CEO Stephan Winkelmann. Apart from the high import duty, the late launch of its new model Huracan into India market was another reason for lower sales this year. The company expects to improve the sales next year. Lamborghini is also considering the possibility of launching its SUV in India by 2018. In April 2012 the company showcased its concept SUV at the Beijing Auto Show.

Which of the following statements is true according to the given passage?

- (1) Lamborghini is the only company to flourish better in India when it comes to car sales.
- (2) The new model Huracan's predecessor is Mercedes' C- class
- (3) Lamborghini proliferates augmentation in India.
- (4) Mercedes- Benz is an adherent of Lamborghini.

7) DIRECTIONS: Read the following passage carefully and mark the correct answer for the questions given below:

Italian super - luxury sports car manufacturer Lamborghini has spread its wings in India, and it has just opened a dealership in Bengaluru, the IT (information technology) capital of the country. It has already a dealership in Mumbai, the financial capital, and Delhi, the political capital. At a price tag of over Rs. 1 Crore. Who will buy a Lamborghini car? Rather, what gives the Italian car maker the confidence to not only drive into India but also expand its presence? The choice of its location for dealership gives a clue or two to its game plan, and also an insight into its prospective customer profile. While dealership in Mumbai and Delhi are understandable considering the wealth and power that reside in these two metros, the choice of Bengaluru to locate its new dealership indicates that the Italian company is betting big on the neo rich who have sprouted in big numbers in the wake of an unprecedented growth experienced by this city. If super - luxury brand like Lamborghini is sensing an unfolding big opportunity in a New India, other traditional global luxury car makers have turned very ambitious with new launches. Despite high import duty barriers, global luxury car makers continue to believe that roll out new models and ramp up dealership in a bid to sustain the appetite of India's super rich for expensive cars is only likely to grow. After the launch of BMW M5, priced at Rs. 1.35 crore its German rival Mercedes - Benz launched next - generation C- Class, priced at Rs. 40.9 lakh in New Delhi. The C- Class is one of the most successful products of Merc in India. It has so far sold over 20,000 units C- class in India. Till date, Lamborghini had sold around 94 sports cars in the country. It said the high import duty would impact the company's sales

in India, and 2014 might see a lower volume. In 2013, it sold around 22 super - luxury sports cars in India. "The import duty in India is higher than many other countries. We want to sell more cars in the country but the import duty in India is high as much as 167 percent. This huge import tax will impact the sales of the super cars in the country," said Automobile Lamborghini President and CEO Stephan Winkelmann. Apart from the high import duty, the late launch of its new model Huracan into India market was another reason for lower sales this year. The company expects to improve the sales next year. Lamborghini is also considering the possibility of launching its SUV in India by 2018. In April 2012 the company showcased its concept SUV at the Beijing Auto Show.

What can be concluded from the passage about the buyers and sellers of Lamborghini cars?

- (1) People in India have a good preference and knowledge about the Lamborghini car.
- (2) Buyers are afar of sellers in India, therefore new metropolitan city was opted to launch a new dealership.
- (3) Regarding car sales competitive environment is ubiquitous in India.
- (4) Only 1 and 2

8) DIRECTIONS : Choose the pair of words which are related to each other same as the capitalized words given below:

AMNESIA:MEMORY::ANARCHY:___?

- (1) Government
- (2) Dynasty
- (3) Turpitude
- (4) Monarch

9) DIRECTIONS : Choose the pair of words which are related to each other same as the capitalized words given below:

UXORIOUS:WIFE::CHAUVINIST:___?

- (1) Idealist
- (2) Cavalry
- (3) Country
- (4) Treachery

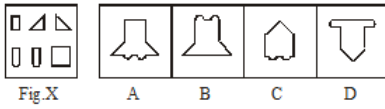
10) DIRECTIONS : Read the following phrase and mark the option that explains it the best:

Person having split personalities

- (1) Pyromaniac
- (2) Callophobia
- (3) Paranoic
- (4) Schizophrenia

PART-IV(B) : LOGICAL REASONING

1) Identify the figure that can be formed by the pieces given in the figure X.

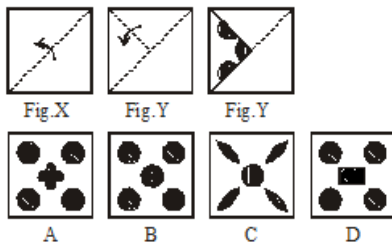


- (1) A
- (2) B
- (3) C
- (4) D

2) Choose the set of alphabets which is different from the rest in the given group.
DFJP, GIMS, MORV, BDHN, FHLR

- (1) GIMS
- (2) FHLR
- (3) MORV
- (4) BDHN

3) Identify the figure (out of Figures A, B, C and D) that most closely resembles the unfolded form of the figure Z (after cutting out the shaded part out of it).

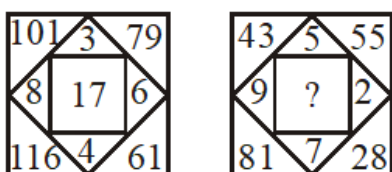


- (1) A
- (2) B
- (3) C
- (4) D

4) Select the option to replace the question mark in the given analogy
Mother : Maternal :: Father : ?

- (1) Fatherly
- (2) Fraternal
- (3) patriarchy
- (4) Paternal

5) Select the correct option to replace the question mark in the given figure.



- (1) 9

- (2) 10
- (3) 11
- (4) 12

6) Identify the set of figures which follows the given rule.
 Rule: The figure becomes complex as it proceeds.

(1)

(2)

(3)

(4)

7) Choose the figure to complete the given pattern.

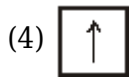
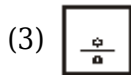
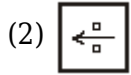
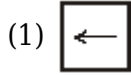
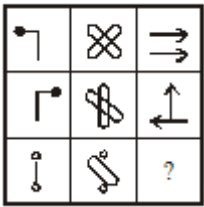
(1)

(2)

(3)

(4)

8) Identify the figure that completes the given figure matrix.



9) Read the given paragraph carefully and select the suitable option to answer which assumptions are correct.

Statement: According to some leading fashion experts, India's fashion retail market will grow up to 115 billion US dollars by 2026. Unlike other countries, Indians prefer value-for-money fashion. Indians don't look for durable fashion these days; instead they hunt for good bargains in trendy apparels. A decade ago, people preferred buying less but expensive durable apparels, while the recent days witness people who are less concerned about the durability of the apparels, but wish to shop more variety for lesser price.

Assumptions:

I. Indians bargain to get a value-for-money deal.

II. People prefer inexpensive fashion.

III. Indian fashion industry will experience a rapid growth by 2026 as per some leading fashion experts in India.

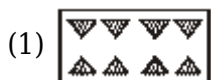
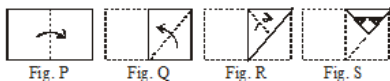
(1) Only I is implicit.

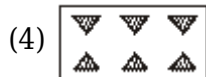
(2) Only I and II are implicit.

(3) Only II and III are implicit.

(4) All, I, II and III are implicit.

10) Identify the figure (out of Figure A, B, C, and D) that most closely resembles the unfolded form of the figure S (after cutting out the shaded part out of it).





11) 3, 13, 31, 57,

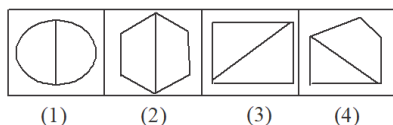
(1) 65

(2) 72

(3) 88

(4) 91

12) Direction:- Out of the four figures (1), (2), (3) and (4) given in each problem, three are similar in a certain way. Choose the figure which is different from the other figures.



(1) 1

(2) 2

(3) 3

(4) 4

13) If the following alphabets are written in reverse order A B C D E F G H I J K L M N O P Q R S T U V W X Y Z then which alphabet will be fourth letter to the left of the fifteenth letter from the right?

(1) T

(2) S

(3) R

(4) B

14) Jatin goes 14 Km towards west and then he goes 3 Km towards south. Then he again goes 10 Km towards east. How far is he now from his starting point?

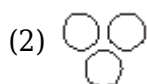
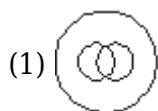
(1) 12 Km

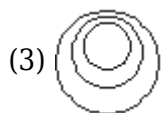
(2) 10 Km

(3) 15 Km

(4) 5 Km

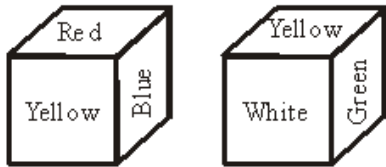
15) Which of the following figure represents Human, Teacher and Graduates





(4) None of these

16) Given below a dice whose six sides have been colored with different colours



Study the given situation and find out which colour will be opposite to blue colour?

(1) White

(2) Red

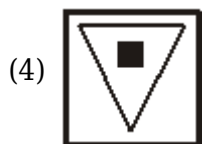
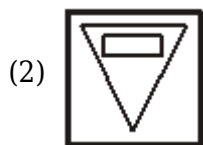
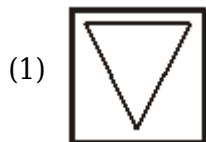
(3) Yellow

(4) Green

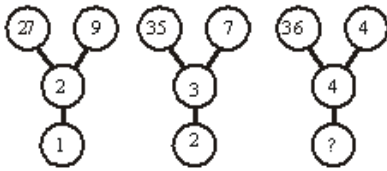
17) Problem Figure



Answer Figure

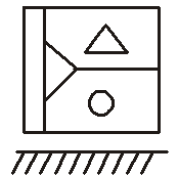


18) Direction :- Observe the mutual relationship between the numbers / figures in the matrix and find out the number / figure that will come in place of question mark (?).



- (1) 3
- (2) 4
- (3) 5
- (4) 6

19) Choose the correct water image of problem figure from the options given in the answer figures.
Problem Figure



- (1)
- (2)
- (3)
- (4)

20) Five boys took part in race, Raj finished before Mohit but behind Gaurav, Ashish Finished before SANJIT but behind Mohit, who won the race?

- (1) RAJ
- (2) Gaurav
- (3) Mohit
- (4) Ashish

ANSWER KEYS

PART-I : PHYSICS

Q.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A.	2	3	1	3	4	4	2	4	1	1	1	4	2	1	2	4	2	4	1	4
Q.	21	22	23	24	25	26	27	28	29	30										
A.	1	4	1	1	2	1	3	3	4	2										

PART-II : CHEMISTRY

Q.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
A.	3	3	3	2	2	4	4	2	3	3	4	1	2	2	4	1	3	3	3	3
Q.	51	52	53	54	55	56	57	58	59	60										
A.	4	2	2	2	1	3	4	3	1	1										

PART-III : MATHEMATICS

Q.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
A.	2	4	2	4	4	1	3	3	1	2	1	2	4	1	1	1	3	4	3	1
Q.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
A.	2	3	1	2	2	4	2	3	1	1	1	1	2	2	4	1	2	3	1	2

PART-IV(A) : ENGLISH PROFICIENCY

Q.	101	102	103	104	105	106	107	108	109	110
A.	2	2	1	4	3	3	3	1	3	4

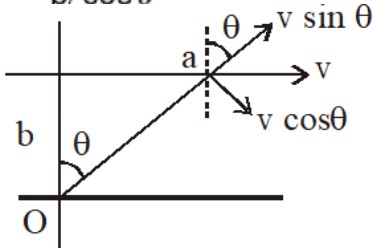
PART-IV(B) : LOGICAL REASONING

Q.	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
A.	A	3	B	4	1	1	4	3	2	3	4	4	2	4	1	1	4	3	2	2

SOLUTIONS

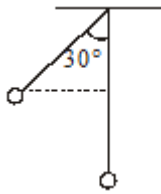
PART-I : PHYSICS

5) $OQ = \frac{b}{\cos \theta}$
 $w = \frac{v \cos \theta}{b / \cos \theta}$



$\frac{v}{b} \cos^2 \theta$
 $= b$

6) $SL_1 - SL_2 = 10 \log_{10} \left(\frac{I_{\max}}{I_{\min}} \right)$
 $= 10 \log_{10} \left(\frac{A_1 + A_2}{A_1 - A_2} \right)^2$
 $\Rightarrow SL_1 - SL_2 = 20 \log_{10} \left[\frac{\frac{A_1}{A_2} + 1}{\frac{A_1}{A_2} - 1} \right]$
 $= 20 \log_{10} 10 = 20 \text{ dB}$

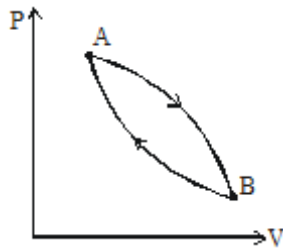


7)

$$mg (\ell - \ell \cos 30^\circ) = \frac{1}{2} mv^2$$

$$v = \sqrt{40 \left(1 - \frac{\sqrt{3}}{2} \right)} = \sqrt{5.6} \approx 2.6$$

$$f_{\max} = \frac{332}{332 - 2.6} \times 1000 = 1007 \text{ Hz}$$



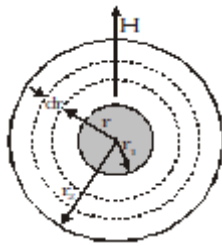
8)

In A - B

$$\Delta Q = \Delta U + W$$

$$0 = \Delta U = -W$$

$$\Delta U = -(70) \text{ J}$$



10) Consider a concentric spherical shell of radius r and thickness dr as shown in figure. The radial rate of flow of heat through this shell in steady state will be

$$H = \frac{dQ}{dt} = -KA \frac{dT}{dr} = -K(4\pi r^2) \frac{dT}{dr}$$

$$\Rightarrow \int_{r_1}^{r_2} \frac{dr}{r^2} = -\frac{4\pi K}{H} \int_{T_1}^{T_2} dT$$

$$H = \frac{dQ}{dt} = \frac{4\pi K r_1 r_2 (T_1 - T_2)}{r_2 - r_1} \Rightarrow \frac{dQ}{dt} \propto \frac{r_1 r_2}{(r_2 - r_1)}$$

11) Steady-state current in $L = i_0 = \frac{\epsilon}{R_1}$. Energy stored in $L = \frac{1}{2} L i_0^2 = \frac{1}{2} L \left(\frac{\epsilon^2}{R_1^2} \right) = \text{heat}$ produced in R_2 during discharge.

12) $\frac{f_{\max}}{\Delta f_{\text{half of max power}}} = \text{Quality factor}$

13) $F_{\max}$ when $\frac{Q}{2}$ each

14) Work done by field W
 $= -\Delta U = U_A - U_B = (-e)V_A - (-e)V_B$
 $\Rightarrow 1.28 \times 10^{-18} = 1.6 \times 10^{-19} (V_B - V_A)$
 $\Rightarrow V_B - V_A = 8 \text{ volt}$
 $\Rightarrow V_E - V_D = V_A - V_B = -8 \text{ volt}$

15) Free surface of liquid is perpendicular to g_{eff} . In the given situation g_{eff} ($g \cos \theta$) is perpendicular to the plane. Therefore free surface is parallel to free surface.

$$16) KE = K \propto t$$

$$K = \frac{1}{2}mv^2 = (\text{constant}) t$$

$$v = \left[\frac{2(\text{constant})}{m} \right]^{1/2} t^{1/2}$$

$$a = \frac{dv}{dt}$$

$$a \propto \frac{1}{\sqrt{t}}$$

$$F = ma \propto \frac{1}{\sqrt{t}}$$

$$17) P = Fv = bv^3$$

$$\therefore v = \left(\frac{P}{b} \right)^{1/3}$$

$$18) \vec{a}_{cm} = \vec{g} = \frac{m_1 \vec{a}_1 + m_2 \vec{a}_2}{m_1 + m_2}$$

OR

$$\vec{a}_2 = \frac{(m_1 + m_2)\vec{g} - m_1 \vec{a}_1}{m_2}$$

$$21) \epsilon_{eq} = \frac{\frac{\epsilon_1}{r_1} + \frac{\epsilon_2}{r_2}}{\frac{1}{r_1} + \frac{1}{r_2}}$$

It is average, must lie between ϵ_1 & ϵ_2

$$23) \lambda \propto \frac{1^2}{1^2}; \lambda' \propto \frac{2^2}{2^2}; \lambda = \lambda'$$

$$25) \lambda_{\text{electron}} = \frac{hc}{E} \text{ and } \lambda_{\text{proton}} = \frac{h}{\sqrt{2mE}}$$

$$\Rightarrow \frac{\lambda_{\text{proton}}}{\lambda_{\text{electron}}} = c \sqrt{\frac{2m}{E}}$$

$$\Rightarrow \frac{\lambda_{\text{proton}}}{\lambda_{\text{electron}}} \propto \frac{1}{\sqrt{E}}$$

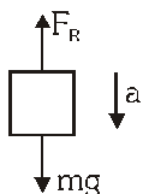
$$26) k = \frac{2W}{x^2}$$

$$[k] = \frac{[ML^2T^{-2}]}{[L^2]}$$

$$= [MT^{-2}]$$

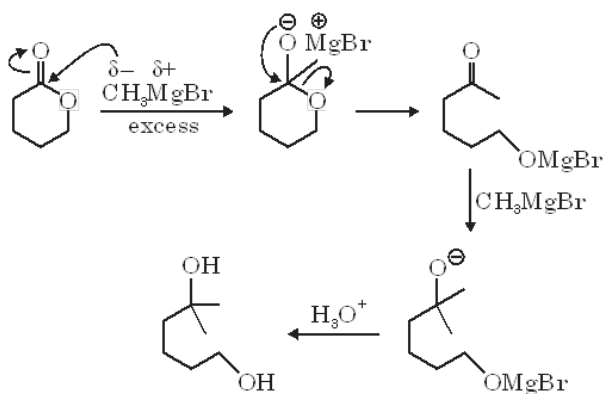
27) Width of central maxima

$$= \frac{2\lambda D}{a} = \frac{2(500 \times 10^{-9})(1)}{(0.1 \times 10^{-3})} m = 10^{-2} m = 10 mm$$



28) $mg - F_R = ma$
 $\Rightarrow F_R = m(g - a) = 80(10 - 6) = 320 \text{ N}$

PART-II : CHEMISTRY



41)

In initial step, reaction follow S_NAE mechanism, followed by Nucleophilic addition mechanism, resulting in formation of 3° Alcohol

PART-III : MATHEMATICS

61) As $t_1 t_2 = 2$, Normals intersect on parabola whose parameter $t_3 = -(t_1 + t_2) = -3 \Rightarrow (9, -6)$

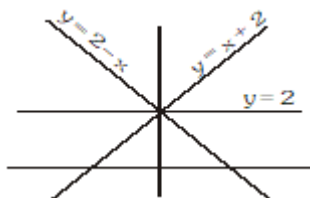
62) The chord of contact of $(2, 3)$ is $3y = 2(x + 2)$ solving it with $y^2 = 4x$

$$y^2 = 2(3y - 4)$$

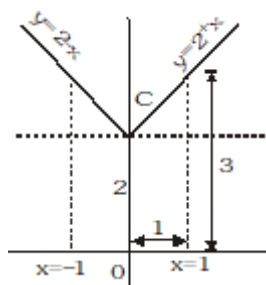
$$\Rightarrow y^2 - 6y + 8 = 0$$

$$\Rightarrow y = 2, 4$$

so $x = 1$ & 4 respectively so points are $(1, 2)$ and $(4, 4)$.



63)



$$y = \max\{2 - x, 2, 2 + x\}$$

$$A(\square OABC) = \frac{1}{2}(2+3) \cdot 1$$

$$\int_{-1}^1 \max\{2 - x, 2, 2 + x\} = 2 \left(\frac{5}{2} \right) = 5$$

$$65) F'(x) = f(x) = \frac{1}{x^2} \int_1^{x^2} \frac{\sqrt{1+u^4}}{u} du$$

$$F''(x) = \frac{\sqrt{1+x^8}}{x^2} \cdot 2x = \frac{2\sqrt{1+x^8}}{x}$$

$$F'''(x) = \frac{2x \cdot \frac{8x^7}{2\sqrt{1+x^8}} - 2\sqrt{1+x^8}}{x^2}$$

$$F'''(1) = \frac{8}{\sqrt{2}} - 2\sqrt{2} = 2\sqrt{2}$$

66) Line equidistant from lines

$$2x + 3y + 5 = 0 \quad \& \quad 2x + 3y - \frac{11}{2} = 0$$

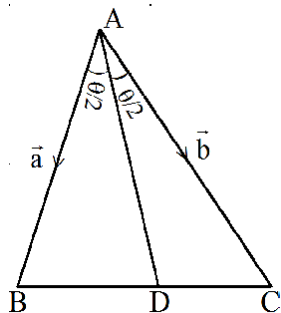
$$\text{is } 2x + 3y + \frac{5 - \frac{11}{2}}{2} = 0$$

$$\text{or } 2x + 3y - \frac{1}{4} = 0$$

$$\text{or } 8x + 12y - 1 = 0$$

$$67) \lim_{t \rightarrow 0} \frac{\frac{t^4}{\int \sin \sqrt{x} dx}}{t^2} = \lim_{t \rightarrow 0} \frac{4t^3 \sin t^2}{2t} - \frac{2t \sin t}{2t} = 0$$

68) Now in $\triangle ABC$



$$\frac{BD}{DC} = \frac{a}{b}$$

$$\therefore BD = ak, DC = bk$$

$$\therefore BC = (a + b)k$$

$$(BC)^2 = (AB)^2 + (AC)^2 - 2AB \cdot AC \cos \theta$$

$$\Rightarrow (a + b)^2 k^2 = a^2 + b^2 - 2ab \cos \theta$$

$$\therefore k^2 = \frac{a^2 + b^2 - 2ab \cos \theta}{(a + b)^2}$$

in ΔADC and ΔABD

$$\cos \frac{\theta}{2} = \frac{b^2 + (AD)^2 - b^2 k^2}{2bAD} = \frac{a^2 + (AD)^2 - a^2 k^2}{2aAD}$$

$$\Rightarrow (AD)^2 = ab(1 - k^2)$$

$$\therefore = ab \left\{ 1 - \frac{a^2 + b^2 - 2ab \cos \theta}{(a + b)^2} \right\} \text{ [from (1)]}$$

$$= \frac{4a^2 b^2 \cos^2 \frac{\theta}{2}}{(a + b)^2}$$

$$= \frac{2ab \cos \frac{\theta}{2}}{(a + b)}$$

$$\therefore AD = \frac{(a + b)}{(\vec{a}b + \vec{b}a)}$$

$$\vec{AD} = \pm \frac{(a + b)}{(a + b)}$$

$$= \pm \frac{ab}{(a + b)} \left(\frac{\vec{a}}{a} + \frac{\vec{b}}{b} \right)$$

$$= \pm \frac{ab}{(a + b)} (\hat{a} + \hat{b})$$

$$\vec{AD} = \pm \frac{(\hat{a} + \hat{b})}{2 \cos \frac{\theta}{2}}$$

$$72) L = \lim_{x \rightarrow 0^+} e^{\ln(\operatorname{cosec} x)^{1/\ln x}}$$

$$= \lim_{x \rightarrow 0^+} e^{\frac{\ln(\operatorname{cosec} x)}{\ln x}}$$

$$= \lim_{x \rightarrow 0^+} e^{\frac{-\cot x}{1/x}}$$

$$= \lim_{x \rightarrow 0^+} e^{\frac{-x}{\tan x}} = e^{-1}$$

$$\Rightarrow \ln L = -1$$

73) Replacing $\frac{dy}{dx}$ by $-\frac{dx}{dy}$ we get

$$\left(\frac{dy}{dx}\right)^2 = \frac{x}{4} \Rightarrow dy = \pm \left(\frac{x^{1/2}}{2}\right) dx$$

Integrating

$$y + c = \pm \frac{x^{3/2}}{3} \Rightarrow 9(y + c)^2 = x^3$$

74) $\lim_{x \rightarrow 1} \frac{(x+8) - (8x+1)}{5-x - (7x-3)} \left(\frac{\sqrt{5-x} + \sqrt{7x-3}}{\sqrt{8+x} + \sqrt{8x+1}} \right)$

$$\Rightarrow \lim_{x \rightarrow 1} \frac{7(1-x)}{8(1-x)} \frac{4}{6} = \frac{7}{12}$$

75) Differentiating w.r.t. x, we get $\frac{dy}{dx} = c$

$$\Rightarrow y = \left(\frac{dy}{dx}\right)x + \left(\frac{dy}{dx}\right)^2 - 3\left(\frac{dy}{dx}\right)^{3/2} + 2$$

clearly its order is 1 and removing the fractional power, it will result into 4th degree

77) $x^2 + y^2 = 5$

$2x + 2yy' = 0$

$\Rightarrow y' = -\frac{x}{y} \dots\dots (i)$

$\Rightarrow y'' = -\left(\frac{y \cdot 1 - x \cdot y'}{y^2}\right) = -\left(\frac{x^2 + y^2}{y^3}\right) \text{ {from (i)}}$

$\Rightarrow y'' = -\frac{5}{y^3}$

$\Rightarrow y'' + 5y^{-3} = 0$

$\Rightarrow 2y'' + 10y^{-3} = 0$

$\therefore k = 10$

78) The vertices of the square will lie on director's circle of ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$

$\Rightarrow$ vertices of square lies on $x^2 + y^2 = 16 + b^2$

$\therefore 2(\text{side of square})^2$

$= (\text{diameter of director's circle})^2$

$\Rightarrow$ Radius of director's circle = 5

$\Rightarrow 16 + b^2 = 25$ or $b = \pm 3$

$\therefore$ Area of ellipse = $\pi(4)(3)$ sq. units

$= 12\pi$ sq. units

80) Clearly $a^2 + 5 > a^2 + 2$

$$\begin{aligned} \text{so } (a^2 + 2) &= (a^2 + 5) \left(1 - \frac{1}{3}\right) \\ 3a^2 + 6 &= 2a^2 + 10 \Rightarrow a^2 = 4 \\ \therefore \text{Equation of the ellipse } \frac{x^2}{6} + \frac{y^2}{9} &= 1 \\ \therefore \text{length of latus rectum} &= \frac{2 \times 6}{3} = 4 \end{aligned}$$

81) The curve is a rectangular hyperbola.
So eccentricity = $\sqrt{2}$

$$\begin{aligned} 82) \frac{dy}{dx} - y &= 1 + x - x^2 \\ (A) \quad f'(x) - f(x) &= 1 + x - x^2 \\ \Rightarrow f'(0) - f(0) &= 1 \\ (B) \quad \text{I.F.} &= e^{\int -1 dx} = e^{-x} \\ \Rightarrow \text{Solution is } y e^{-x} &= \int \frac{1 + x - x^2}{e^x} dx \end{aligned}$$

84) Given system of equation is consistent

$$\Rightarrow \begin{vmatrix} 1 & 1 & 1 \\ t & 1 & t \\ (1+t) & 2 & 3 \end{vmatrix} = 0$$

$$C_3 \rightarrow C_3 - (C_1 + C_2)$$

$$\begin{vmatrix} 1 & 1 & 1 \\ t & 1 & t \\ 0 & 0 & t-2 \end{vmatrix} = 0$$

$$(t-2)(1-t) = 0$$

$$t = 2 \text{ or } t = 1$$

for $t = 1$ system becomes

$$x + y = 1$$

$$x + y = 3/2$$

$\therefore t \neq 1$ so $t = 2$ is the only solution.

$$85) \quad \begin{array}{ccc} + & + & + \\ 1 & 2 & 4 \end{array}$$

Applying LMVT in $[1, 2]$

$$\frac{f(2) - f(1)}{2 - 1} = f'(c_1) \quad \forall c_1 \in (1, 2)$$

$$f(2) - 2 \leq 2 \{ \because f'(x) \leq 2 \} \Rightarrow f(2) \leq 4 \dots (1)$$

Similarly applying LMVT in $[2, 4]$

$$\frac{f(4) - f(2)}{4 - 2} = f'(c_2) \quad \forall c_2 \in (2, 4)$$

$$\frac{8 - f(2)}{2} \leq 2 \Rightarrow f(2) \geq 4 \quad \dots (2)$$

from (1) & (2) $f(2) = 4$

$$86) I = \int_0^{\pi} \frac{x^3 \cos^4 x \sin^2 x dx}{(\pi^2 - 3\pi x + 3x^2)} \dots (i)$$

$$I = \int_0^{\pi} \frac{(\pi - x)^3 \cos^4 x \sin^2 x dx}{(\pi^2 - 3\pi(\pi - x) + 3(\pi - x)^2)}$$

$$I = \int_0^{\pi} \frac{(\pi - x)^3 \cos^4 x \sin^2 x dx}{(\pi^2 - 3\pi x + 3x^2)} \dots (ii)$$

add (i) & (ii)

$$2I = \int_0^{\pi} \cos^4 x \sin^2 x dx$$

$$2I = 2\pi \int_0^{\pi/2} \cos^4 x \sin^2 x dx \dots (iii)$$

$$I = \pi \int_0^{\pi/2} \sin^4 x \cos^2 x dx \dots (iv)$$

$$(iii) + (iv) \Rightarrow 2I = \pi \int_0^{\pi/2} \sin^2 x \cos^2 x dx$$

$$I = \frac{\pi}{2} \int_0^{\pi/2} \frac{(\sin 2x)^2}{4} dx = \frac{\pi}{8} \int_0^{\pi/2} \sin^2 x dx$$

$$88) I_2 = \int_0^1 \frac{x^2 dx}{e^{x^3}(2 - x^3)}$$

$$\{ \text{Let } 1 - x^3 = t \quad x^2 dx = -\frac{1}{3} dt \}$$

$$= -\frac{1}{3} \int_1^0 \frac{dt}{e^{1-t}(1+t)} = \frac{1}{3e} \int_0^1 \frac{e^t dt}{1+t}$$

$$I_2 = \frac{1}{3e} I_1 \Rightarrow \frac{I_1}{I_2} = 3e$$

$$89) (I) \quad \text{Put } x = 0$$

$$\therefore \text{ constant term} = \begin{vmatrix} 2 & 2 & 2 \\ 1 & 0 & -1 \\ 0 & 0 & -2 \end{vmatrix} = 4$$

$$(II) \Delta = \begin{vmatrix} a & c & b \\ b & a & c \\ c & b & a \end{vmatrix} = a^3 + b^3 + c^3 - 3abc$$

$$= (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ac)$$

$$= \frac{1}{2}(a+b+c)((a-b)^2 + (b-c)^2 + (c-a)^2)$$

if $a = b = c$, then $\Delta = 0$

$$(III) A^2 = O$$

$$\begin{bmatrix} a & 1 \\ -1 & b \end{bmatrix} \begin{bmatrix} a & 1 \\ -1 & b \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

$$\Rightarrow a^2 = 1, a + b = 0 \text{ \& } b^2 = 1$$

$$\therefore a = 1, b = -1 \text{ or } a = -1, b = 1$$

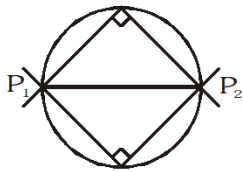
$$\Rightarrow ab < 0$$

$$\begin{bmatrix} 1 & x & 3 \end{bmatrix} \begin{bmatrix} 2 & -1 \\ 6 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 9 \end{bmatrix} = [2 + 6x \quad 8 + x] \begin{bmatrix} 1 \\ 9 \end{bmatrix}$$

$$(IV)$$

$$= [15x + 74]$$

$$\therefore 15x + 74 = 14 \Rightarrow x = -4$$



91)

Let P_1 be the point of intersection of the I family & P_2 be the point of intersection of II family
The locus is a circle & points of concurrency of both the family being the end points of diameter.

$$92) A = A^T, B = B^T, C^T = -C$$

$$D = ABC - CBA \quad \dots(i)$$

$$D^T = C^T B^T A^T - A^T B^T C^T$$

$$D^T = -CBA + ABC \quad \dots(ii)$$

from (i) & (ii), $D = D^T \Rightarrow D$ is symmetric matrix

93) Centre of the required circle is $(-4, -5)$

Radius of the circle is

$$r = \sqrt{(-4-2)^2 + (-5-3)^2} = 10$$

$\therefore$ Equation of the circle

$$(x+4)^2 + (y+5)^2 = 100$$

$$x^2 + y^2 + 8x + 10y - 59 = 0.$$

$$95) (1+x_3)^n - (1-x_3)^n = 2[C_1x^3 + C_3x^9 + C_5x^{15} + \dots]$$

$$x^2[(1+x^3)^n - (1-x^3)^n]$$

$$= 2[C_1x^5 + C_3x^{11} + C_5x^{17} + \dots]$$

Integrating within limits 0 to 1.

$$\begin{aligned} \int_0^1 3x^2[(1+x^3)^n - (1-x^3)^n]dx &= 6 \left[C_1 \frac{x^6}{6} + C_3 \frac{x^{12}}{12} + C_5 \frac{x^{18}}{18} + \dots \right]_0^1 \\ \Rightarrow \left[\frac{(1+x^3)^{n+1} + (1-x^3)^{n+1}}{n+1} \right]_0^1 &= C_1 + \frac{C_3}{2} + \frac{C_5}{3} + \dots \\ \Rightarrow C_1 + \frac{C_3}{2} + \frac{C_5}{3} + \dots &= \frac{2^{n+1}}{n+1} - \frac{2}{n+1} = \frac{2^{n+1}-2}{n+1} \end{aligned}$$

$$96) a = 2, h = 2, b = -k, g = 2, f = 1, c = -1$$

$$abc + 2fgh - af^2 - bg^2 - ch^2 = 0$$

$$2k + 8 - 2 + 4k + 4 = 0$$

$$6k = -10$$

$$\therefore k = -\frac{5}{3}$$

$$97) (\cos 12^\circ + \cos 84^\circ) - (\cos 24^\circ + \cos 48^\circ)$$

$$= 2 \cos 48^\circ \cos 36^\circ - 2 \cos 36^\circ \cos 12^\circ$$

$$= 2 \cos 36^\circ (\cos 48^\circ - \cos 12^\circ)$$

$$= 2 \cos 36^\circ (2 \sin 30^\circ \sin (-18^\circ)) = -2 \cos 36^\circ \sin 18^\circ = -2 \left(\frac{\sqrt{5}+1}{4} \right) \left(\frac{\sqrt{5}-1}{4} \right) = -\frac{1}{2}$$

98) Now

$$\frac{\cos 96^\circ + \cos 6^\circ}{\cos 96^\circ - \cos 6^\circ} = \frac{-2 \cos 51^\circ \cos 45^\circ}{2 \sin 51^\circ \sin 45^\circ} = -\cot 51^\circ$$

$$= \tan 141^\circ = \tan(180^\circ + 141^\circ)$$

$$= \tan 321^\circ = \tan(3.107^\circ)$$

$$\therefore n = 3$$

$$99) a + ar + ar^2 = 21 \quad \dots\dots (i)$$

$$a^2 + a^2r^2 + a^2r^4 = 189 \quad \dots\dots (ii)$$

$$\frac{(\text{equation (i)})^2}{(\text{equation (ii)})} \Rightarrow \frac{(1+r+r^2)^2}{1+r^2+r^4} = \frac{21 \times 21}{189} = \frac{7}{3}$$

$$\frac{1+r^2+r^4+2r(1+r+r^2)}{1+r^2+r^4} = \frac{7}{3}$$

$$1 + \frac{2r(1+r+r^2)}{\{(1+r^2+r)^2 - 2r(1+r+r^2)\}} = \frac{7}{3}$$

$$r = 2, \frac{1}{2}$$

$\therefore$ sum to infinite terms is defined.

$$\Rightarrow r = \frac{1}{2}$$

$$100) \Rightarrow z^2 + \bar{z}^2 = z + \bar{z}$$

$$\Rightarrow (z + \bar{z})^2 - 2z\bar{z} = z + \bar{z}$$

$$\Rightarrow 4x^2 - 2 = 2x \quad \{z\bar{z} = |z|^2 = 1\}$$

$$\Rightarrow x = 1 \text{ or } x = -\frac{1}{2}$$

$$\text{Also } x^2 + y^2 = 1$$

$$\Rightarrow y = 0 \text{ or } y = \pm \frac{\sqrt{3}}{2}$$

Total 3 solution

PART-IV(A) : ENGLISH PROFICIENCY

101) Explanation: The composition of the paragraph makes sense in this arrangement only

102) Explanation: The meaning of Gauche is unsophisticated and socially awkward. In other words Graceless.

103) Explanation: The meaning of Cacophony is a harsh discordant mixture of sounds. In other words jarring sound.

104) Explanation: According to the passage, option D explains the reason best.

105) Explanation: According to the passage, option C explains the reason best.

106) Explanation: According to the passage, option C explains the reason best.

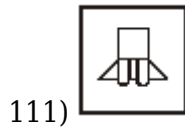
107) Explanation: According to the passage, option C explains the reason best.

108) Explanation: As amnesia is a state of memory loss, Anarchy is a state of disorder due to absence or non-recognition of authority or other controlling systems/Government.

109) Explanation: As uxorious is used for wife, chauvinist is used for patriotism i.e. for a country.

110) Explanation: The one word for a person having split personalities is Schizophrenia.

PART-IV(B) : LOGICAL REASONING



112) Explanation: Except in MORV, each set of alphabets has its first, second and third alphabets are moved two, four and six places forward to get the second, third and fourth alphabets. Therefore, Option C is correct.

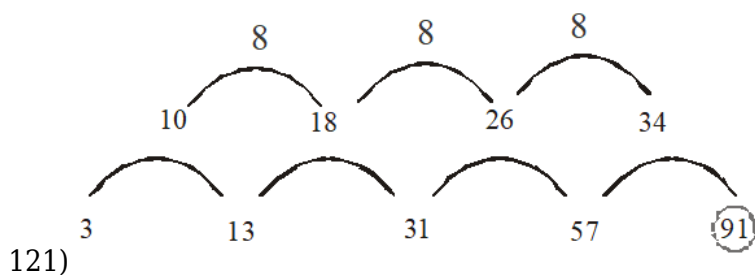
114) Explanation: The word 'maternal' is used to refer the mother's side of family, while the word 'paternal' refers to the father's side of family. Therefore, Option D is correct.

115) $(101+116+79+61) \div (3+8+4+6) = 17$
 $(43+81+28+55) \div (5+9+7+2) = 9$

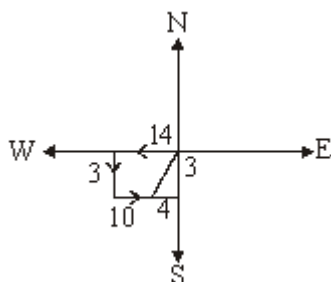


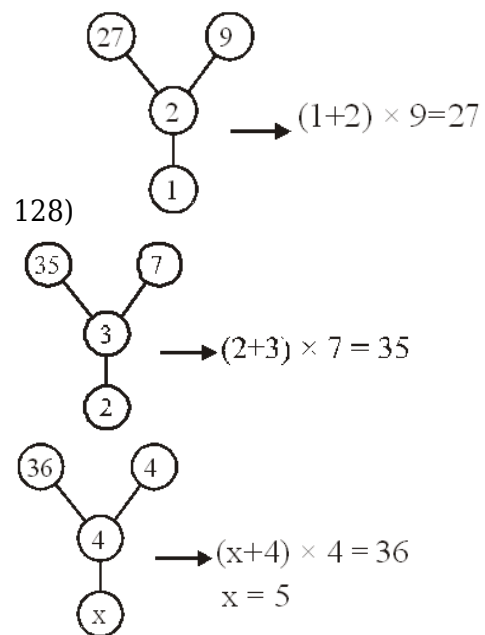
118) Third block in each column contains only the common part of image in the first two blocks of that column along with two hollow circles. Therefore, Option C is correct.

119) It isn't given anywhere in the paragraph that the fashion experts who made the predictions about the growth of Indian fashion industry are Indians. Therefore Option B is correct.



124) $\sqrt{3^2 + 4^2} = 5\text{km}$





129) Figure will be inverted around x-axis (Horizontal)